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Statement of
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Subcommittee on Space and Aeronautics
Committee on Science and Technology
U. S. House of Representatives

Madam Chairwoman and Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss the important topic of space debris. While the adage "what goes up, must come down" still applies in the space age, most satellites take a very long time to fall back to Earth. In many cases, this descent can last hundreds, even thousands, of years. Consequently, after more than 4,600 space missions conducted world-wide since Sputnik 1, a large number of human-made objects have steadily accumulated in Earth orbit. Thus, the numerous operational satellites as well as the human occupied International Space Station now circling the globe, performing vital functions of communications, navigation, Earth observation, science and research, exploration, and defense, are accompanied by a much larger population of defunct spacecraft, derelict launch vehicle orbital stages, intentional refuse, and the products of more than 200 satellite explosions and collisions.

Characterization of the Near-Earth Space Debris Environment

For 30 years, NASA has led the world in scientific studies to characterize the near-Earth space debris environment, to assess its potential hazards to current and future space operations, and to identify and to implement means of mitigating its growth. The near-Earth space debris environment ranges in altitude from 100 to more than 20,000 miles above Earth, and the debris itself ranges in mass from less than an ounce to many tons. Consequently, this population of space debris is a matter of growing concern for all space-faring nations.
Today, the United States Space Surveillance Network, managed by U.S. Strategic Command, is tracking more than 19,000 objects in orbit about the Earth, of which approximately 95 percent represent some form of debris. However, these are only the larger pieces of space debris, typically four inches or more in diameter. The number of debris as small as half an inch exceeds 300,000. Due to the tremendous energies possessed by space debris, the collision between a piece of debris only a half-inch in diameter and an operational spacecraft, piloted by humans or robotic, has the potential for catastrophic consequences.

United States and International Debris Policy

Since 1988, the United States National Space Policy has specifically addressed the need to limit the growth of the space debris population. The current National Space Policy, signed by the President in 2006, charges the U.S. Government agencies and organizations with seeking "to minimize the creation of orbital debris by government and non-government operations in space in order to preserve the space environment for future generations." The policy also states that "The United States shall take a leadership role in international fora to encourage foreign nations and international organizations to adopt policies and practices aimed at debris minimization…"

In 1995, NASA was the first U.S. Government organization to establish formal space debris mitigation guidelines. In 2001, the *U.S. Government Orbital Debris Mitigation Standard Practices*, based upon the NASA space debris mitigation guidelines, were adopted after a lengthy and thorough intergovernmental review and coordination with the aerospace industry. The fundamental elements of these standard practices were adopted in 2002 by the major space-faring nations under the auspices of the Inter-Agency Space Debris Coordination Committee, whose members represent the space agencies of 10 countries, as well as the European Space Agency. In 2007, the United Nations, through the Committee on the Peaceful Uses of Outer Space, adopted a similar set of space debris mitigation guidelines.

NASA Debris Avoidance and Mitigation

While NASA continues to promote the curtailment of the generation of new space debris, we must operate in the existing debris environment. To this end, NASA designs spacecraft to withstand the impacts of small debris, and the Agency works with the U.S. Space Surveillance Network to avoid collisions between our space assets and other known resident space objects. NASA procedural requirements call for conjunction assessments, *i.e.*, close approach predictions, to be performed for all our maneuverable spacecraft. During 2008, NASA twice maneuvered robotic spacecraft of the Earth Observation System in low Earth orbit and once maneuvered a Tracking and Data Relay Satellite in geosynchronous orbit to avoid potential collisions. Twice since last August, the International Space Station has conducted collision avoidance maneuvers.

For the 35 years from mid-1961 to mid-1996, the population of cataloged objects (i.e., objects that are four inches in size or larger) in Earth orbit increased at an average rate of 270 per year. However, with the concerted efforts of the major space-faring nations of the world, the rate dropped dramatically to only 70 per year for the next decade. Unfortunately, the intentional destruction of the Chinese Fengyun-1C weather satellite in January of 2007 and the accidental collision of American and Russian spacecraft in February of this year have increased the cataloged debris population by nearly 40 percent, in comparison with all the debris remaining from the first 50 years of the Space Age.

The recent collision of two intact satellites underscores a NASA 1970s-era finding, reiterated more recently in a NASA study published in *Science* in 2006, that the amount of debris already in Earth orbit is sufficient to lead to more accidental collisions, which in turn will lead to an unintended increase in space debris and increased risk to operational space systems. In the future, such collisions are likely to be the principal source of new space debris. The most effective means of limiting satellite collisions is to remove non-functional spacecraft and launch vehicle orbital stages from orbit. However, the remediation of the near-Earth space environment presents substantial technical and economic challenges.

Conclusion

The threat posed by orbital debris to the reliable operation of space systems will continue to grow unless the sources of debris are brought under control. The international aerospace community has already made significant strides in the design and operation of space systems to curtail the creation of new orbital debris, but more can be done.

Currently, the Department of Defense Commercial and Foreign Entities program is the principal means of distributing space situational awareness data to space system operators and the general public. Enhancements to this program, both to serve a larger number of users and to increase the variety of services available, especially conjunction assessments, offer the greatest near-term and lowest cost improvement to space safety. In the longer-term, technical advances in space surveillance, including more capable sensors and higher accuracy data, are likely needed.

I would be happy to respond to any question you or the other Members of the Subcommittee may have.